

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF
HARVARD UNIVERSITY—No. CLIX

SOME NORTH AMERICAN CORYLACEAE
(BETULACEAE)

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(Plates 963–989)¹

I. NOTES ON *BETULA* IN EASTERN NORTH AMERICA

(Plates 963–975)

It has long been evident that the ultraconservative treatment of *Betula*, published by me in 1902, as *Relationships of some American and Old World Birches*², can not be accepted, in view of the many characters of aments, their bracts and samaras then not understood. That sophomoric study, based on complete lack of understanding, well illustrates how an over-conservative treatment may be as far afield as are those which split beyond the normal divergencies in Nature. In a recent attempt to set in order the White Birches and the Dwarf Birches as they occur in the Gray's Manual range the names applied to our species and varieties have necessarily changed in several cases. The entire treatment can hardly be given here, but, in order to clarify the situation, the key to our members of Series *Albae* is here given.

- a. Bark opaque, chalky- or ashy-white, close, the layers not readily exfoliating; staminate ament usually 1 and, before expanding, pointing stiffly forward; leaves glabrous or merely glutinous on both sides, abruptly ending in prolonged tail-like tips (caudate); fruiting aments 1–2.5 cm. long; their mature bracts nearly horizontally divergent, crowded, 3–4.5 mm. long, uniformly ashy-puberulent on back. 1. *B. populifolia*.
- a. Bark lustrous, creamy- or pinkish-white to warm-brown, in maturity often exfoliating or separating into layers; staminate aments 1–few; leaves not prominently caudate-tipped; fruiting aments (except in the dwarf shrubby no. 4) mostly larger; their bracts (except in the introduced no. 2) ascending, glabrous or pilose on back, the lobes ciliate. . . . b.
- b. Samaras 3.5–6.5 mm. broad, the wings broader than the achene; trees or coarse shrubs.

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² Contrib. Gray Herb. n. s. xxiii., Am. Journ. Sci., ser. 4, xiv. 167–194, plates v and vi (1902).

- c. Leaves glabrous on both sides; young shoots glabrous or merely with resinous warts. . . . d.
- d. Trees with whitish bark; leaves deltoid-ovate, acuminate from broad base, those of fertile branches 3-10 cm. long; staminate aments 4-10 cm. long; lateral lobes of pistillate bracts divergent, larger than terminal lobe; species of low or intermediate altitudes.
Leaves of fertile branches 3-7 cm. long, their cuneate to truncate bases entire; fruiting aments 2-4 cm. long, their bracts divergent; introduced species. . . 2. *B. pendula*.
Leaves of fertile branches 5-10 cm. long, their rounded bases toothed except near petiole; fruiting aments 2.5-5 cm. long, their bracts ascending; indigenous. 3. *B. caerulea-grandis*.
- d. Shrub with dark close bark; leaves ovate, merely acute to blunt, those of fruiting branches 1.5-4.5 cm. long; staminate aments 1.5-3.5 cm. long; lateral lobes of pistillate bracts ascending, scarcely broader than terminal lobe; subarctic-alpine species. 4. *B. minor*.
- c. Leaves pubescent beneath, at least when young, or on veins or in their axils; young vegetative shoots pubescent or puberulent.
Buds lustrous with resin; leaves merely acute, those of fertile branches 3-5 cm. long; mature fertile aments 1.5-3 cm. long; introduced species. 5. *B. alba*.
Buds scarcely resinous; leaves mostly acuminate, those of fertile branches 2.5-10.5 cm. long; mature fertile aments 1.5-6.5 cm. long; indigenous. 6. *B. papyrifera*.
- b. Samaras 2-3.5 mm. broad, the wings scarcely to barely as broad as the achene; new sprouts pubescent; leaves elliptic, rhombic-oval or ovate; shrub with close dark bark. 7. *B. borealis*.

1. *B. POPULIFOLIA* Marsh. Arb. Am. 19 (1785). *B. alba* L., var. *populifolia* (Marsh.) Spach, Ann. Sci. Nat. sér. 2, xv. 187 (1841).—Sterile dry to wet acid soils, Prince Edward Island to Laurentide region of Quebec, west to southern Ontario, south to Delaware, Pennsylvania, upland to Virginia, northern Ohio and northern Indiana.

B. POPULIFOLIA Marsh., forma ***incisifolia***, f. nov., foliis lacerato-incisis, laciniis attenuatis plus minusve incisis.—MASSACHUSETTS: old field at border of woods, Auburndale, July 23, 1941, *D. S. Correll* (TYPE in Herb. N. E. Bot. Club). PENNSYLVANIA: along trail just north of highway, below the Pagoda, Mt. Penn, Berks Co., Aug. 14, 1943, a single young individual, *Wherry*. Illustrated as var. *laciniata* Loud. by Correll in *RHODORA*, xliv. plate 708 opp. p. 236 (1942).

Unfortunately the name *Betula populifolia*, var. *laciniata* (Lodd.) Loud., currently used for this "cut-leaved" form, is not a safe one to take up. The identity is too doubtful since Loudon based it on a *nomen nudum* which had been published by Conrad Loddiges and Sons, Nurserymen, in their 16th Catalogue

of Plants, 44 (1836). Loddiges and Sons merely had the name *Betula laciniata* in a list of hardy trees and shrubs cultivated by them. There was no description; consequently when Loudon, Arb. and Frut. Brit. iii. 1707 (1838), published *B. populifolia*, var. *laciniata*, "*B. laciniata* Lodd. Cat. ed. 1836, has large, smooth, shining, deeply cut leaves, and appears to us to belong to *B. (a.) populifolia*, rather than to *B. alba*", he based his combination on a *nomen nudum*. If he had omitted the citation of Loddiges' identical *nomen* which was further invalidated by the well described *B. laciniata* Ehrh. (1788), the case would be different. At least, if it be maintained that Loudon gave a sufficient diagnosis and thus validated the name, it is not at all certain what he had. It is safer to establish our indigenous form on surer ground.

2. *B. PENDULA* Roth, Tent. Fl. Germ. i. 405 (1788). *B. alba* L. Sp. Pl. 982 (1753), in part; Koch, Syn. 662 (1837). *B. alba*, β . *pendula* Ait. Hort. Kew. iii. 336 (1789). *B. verrucosa* Ehrh. Beitr. vi. 98 (1791–1793).—Introduced from Europe; spread to roadsides, thickets, open woods, etc., Nova Scotia to Ontario, south to Pennsylvania, Michigan, Wisconsin and Iowa.

Forma DALECARLICA (L. f.) Schneid. Handb. Laubholzk. i. 112 (1904). *B. alba*, β . *dalecarlica* L. f. Suppl. 416 (1781).—Similarly spreading from cultivation.

Those who treat this half of the mixed *Betula alba* L. as typical *B. alba* (for instance Beck von Mannagetta and Wilmott) go back only to Koch (1837) for their cue. Evidently they have overlooked the fact that Roth in 1788 had removed *B. pendula*, thus leaving the other species (*B. pubescens* Ehrh., 1791) to stand as true *B. alba*. See comments under our no. 5.

3. *B. CAERULEA-GRANDIS* Blanchard, *Betula*, i. no. 1 (May 7, 1904); Fernald in RHODORA, xxiv. 171 (1922). *B. caerulea* Blanchard, var. *grandis* Blanchard in Vermont Phoenix for May 13, 1904 and *Betula*, i. no. 2 (May 13, 1904). *B. caerulea*, var. *Blanchardi* Sargent, Man. Trees. N. A. 202, fig. 168A (1905).—Dry woods, Gaspé Peninsula to Montmorency Co., Quebec, south to Nova Scotia, northern New England and eastern New York.

× *B. CAERULEA* Blanchard, *Betula*, i. no. 1 (May 7, 1904); Sargent, Man. 201, fig. 168 (1903); Fernald in RHODORA, l. c. 172 (1922)—A hybrid of no. 3 with no. 1, occasional where they are together.

4. *B. minor* (Tuckerm.), stat. nov. *B. papyracea*, var. *minor* Tuckerman in Am. Journ. Sci. xlv. 31 (1843). *B. dahurica*, β . *americana* Regel in DC. Prodr. xvi². 175 (1868). *B. alba*, subsp. *papyrifera*, β . *humilis* Regel, l. c. 166 (1868), in small part only (i. e. *B. papyracea*, var. *minor* Tuckerm., the TYPE of which is also the type of Regel's *B. dahurica*, var. *americana*!) *B. papyrifera*, var. *minor* (Tuckerm.) Wats. & Coult. in Gray, Man. ed. 6, 472 (1889), at least in part. *B. odorata*, var. *tortuosa* sensu¹ Fernald in RHODORA, iii. 173 (1901), not (Ledeb.) Lange. *B. alba*, var. *minor* (Tuckerm.) Fernald in Am. Journ. Sci. ser. 4. xiv. 179 (1902).—Acidic rocky barrens, peats and alpine summits, Labrador Peninsula, south to Newfoundland, Shickshock Mts., Gaspé Peninsula, and Laurentide Mts., Quebec, highest mountains of northern New England and northeastern New York, and shores of James Bay, Ontario. The following are characteristic. LABRADOR: head of pond, 30 miles west of Nain, Anatolak Bay, Potter & Brierly, no. 2614; Anatolak, C. S. Sewall, no. 449; Hopedale, Aug., 1935, Agnes Ayre; granite hills, Salmon Bight, 53° 27' N., 55° 47' W., A. E. Porsild, no. 37, as *B. papyrifera*, var. *cordifolia*; Square Island, lat. 52° 49', Aug. 16, 1882, J. A. Allen; large shrubs on upper crests and on gneiss plain, Blanc Sablon, Fernald & Wiegand, nos. 3248 and 3249. NEWFOUNDLAND: shrub 0.5–0.8 m. high, turfey and rocky slopes of Cape Dégrat, Quirpon Island, Fernald & Long, no. 28,071, erroneously distributed as *B. microphylla* Bunge; thickets, brooksides and ravines, western side of Quirpon I., Wiegand, Gilbert & Hotchkiss, no. 28,076 (as *B. microphylla*); quartzite one half mile south of Deer Pond, Highlands of St. John, Wiegand, Gilbert & Hotchkiss, no. 28,078 (as *B. microphylla*); erect, 1 m. or less high, peaty or turfey upper quartzite slopes, alt. 600–650 m., Killdevil, Bonne Bay, Fernald, Long & Fogg, no. 1635 (as *B. microphylla*); diorite tableland, alt. about 550 m., northern region of the Blomidon ("Blow-me-down") Mts., Bay of Islands, Fernald & Wiegand, no. 4263; diorite tableland, near Franchman's Cove, Bay of Islands, Griscom, no. 10,242; about 4 feet high, Riverview Camp, Grand Codroy R., Pease & Edgerton, no. 27,113; damp thickets on hill southwest of Tilt Cove, Notre Dame Bay, Fernald & Wiegand, no. 5307. QUEBEC: rocky hillsides, Vieux-Fort, Pontchartrain, Saguenay Co., St. John, no. 90,831 (as *B. glandulosa*); tundra, Ile Herbée, Archipel de Vieux-Fort, St. John, no. 90,832 (as *B. glandulosa*); sur les gneiss près des chutes, Natashquan, Côte-Nord, Victorin & Rolland, no. 28,101 (as *B. microphylla*); Seven Islands, Saguenay Co., C. B. Robinson, nos. 864 and 867; plateau dénudé, Botanists' Dome, Montagne de la Table, Rousseau & Fortier, no. 31,429; abundant près du sommet, Mt. Lyall, Gaspé Co., Victorin, Rolland &

¹ For these more erroneous identifications one is tempted to write "nonsensu."

Jacques, no. 33,516 (as *B. microphylla*); parties sèches près des sommets, Mont Sterling, Gaspé Co., *Victorin, Germain & Jacques*, no. 33,481 (as *B. microphylla*); rocky slopes and barrens, alt. 650–1100 m., Mt. Albert, Gaspé Co., *Collins & Fernald*, no. 67; on hornblende schist, alt. 900–1060 m., north slope, Mt. Albert, *Fernald & Collins*, nos. 214 and 529 (as *B. microphylla*); sur les schistes hornblendiques et les paragneiss, Mt. Albert, *Victorin, Brunel, Rolland & Rousseau*, no. 17,598 (as *B. pumila* ?); bare hornblende schist near summit, about 1100 m. alt., Mt. Fortin, Matane Co., *Fernald & Pease*, nos. 25,023 and 25,024 (as *B. microphylla*); Port à Pueis, below Cap à l'Aigle, *J. Macoun*, no. 68,776. MAINE: summit of Mt. Katahdin, Aug., 1847, *Aaron Young*, Bot. Surv. Me., Aug. 25, 1847, *George Thurber*, Aug. 12, 1873, *Scribner*, Aug. 1874, *Scribner* (as *B. glandulosa*), Sept. 1898, *E. D. Merrill* (as *B. glandulosa*); small shrubs, summit of 1st North Peak, Mt. Katahdin, July 14, 1900, *Fernald*. NEW HAMPSHIRE: "In alpinis Mont. Alborum", *Tuckerman* (ISOTYPE); White Mts., 1842, *A. Gray*, this and the preceding the types of *B. dahurica*, var. *americana* Regel; Alpine Garden, Mt. Washington, July 10, 1893, *E. & C. E. Faxon*, June 26, 1898, *E. F. Williams* (as *B. glandulosa*), Aug. 5, 1901, *Robinson*, August 13, 1902, *Pease*, no. 445, July 31, 1926, *Pease*, no. 19,828; Oakes Gulf, Mt. Washington, July 4, 1878, *Faxon* (as *B. glandulosa*), July 8, 1895, *Kennedy, Williams*; Oakes Gulf, *Eggleston*, no. 2376 (as *B. odorata*, var. *tortuosa*); 5-mile post on Carriage Road, Mt. Washington, July 27, 1886, *Faxon* (as *B. glandulosa*), *Greenman*, no. 1088 (as *B. glandulosa*), *Pease*, no. 10,532; "Cape Horn", Mt. Washington, June 24, 1898, *Williams, Robinson*, no. 955; Lake of the Clouds, Mt. Washington, July 4, 1878, *Faxon* (as *B. glandulosa*), *Pease*, no. 446; near Duck Fall, Low & Burbank Grant, *Pease*, no. 14,160; Nowell's Ridge, Low & Burbank Grant, *Pease*, no. 12,316; Ice Gulch, Randolph, *Pease*, nos. 10,750 ("trees 2 ft. high"), 16,707; upper rocky slopes of Mt. Lafayette, *St. John*, no. 439. NEW YORK: summit of Mt. McIntyre, alt. 4800–5000 ft., *House*, no. 9488. ONTARIO: Hasey Island, Moose River, James Bay, *D. Potter*, no. 804. PLATE 963, FIGS. 1–7.

Betula minor closely simulates the Arctic Eurasian and Greenland shrub, there passing as *B. alba*, var. *tortuosa* (Ledeb.) Schneider or *B. odorata* Bechst., var. *tortuosa* (Ledeb.) Lange or *B. tortuosa* Ledeb. (PLATE 963, FIG. 11). That shrub, however, apparently an arctic extreme of *B. alba*, has the samaras elliptic to obovate (as long as or longer than broad) with wings about equaling the narrow achene. *B. minor*, on the other hand, has the broadly subreniform samaras definitely broader than long,

the wings as broad as or broader than the broadly elliptic achene. A great number of specimens (through my original sin) have been misidentified as the Siberian *B. microphylla* Bunge, but that poorly understood species seems to be unlike anything American (see discussion under *B. borealis*). As for its relationship to *B. papyrifera*, *B. minor* has, somewhat naturally, been inferred to be merely a dwarfed alpine or subarctic extreme of the tree of lower altitudes and more favorable climatic conditions. Examination of the two, however, brings out several important characters. In *B. papyrifera* (PLATES 964, 965 and 967-972) the vigorous young shoots are pubescent; in *B. minor* glabrous but often so gummy as to be mistaken for those of *B. glandulosa*. In *B. papyrifera* the expanding leaves are pubescent beneath, the mature ones with traces of pubescence beneath, at least in the axils of the veins. In *B. papyrifera* the bracts of the pistillate aments (except in vars. *macrostachya* and *cordifolia*) have broad and widely divergent lateral lobes; in *B. minor* the lateral and terminal lobes are of about the same breadth and porrect. Although the lateral lobes of *B. papyrifera*, vars. *macrostachya* (PLATE 968) and *cordifolia* (PLATE 970) are porrect, the bracts are much longer than in *B. minor* and the other characters sufficiently different: both with pubescent new shoots and young foliage, var. *macrostachya* with mature fruiting aments 1.3-2 cm. thick, the samaras 5-6 mm. broad; var. *cordifolia* similar but with definitely cordate leaves; *B. minor* glabrous from the first, often gummy, with very short staminate and fruiting aments, the latter at most 9 mm. thick, and samaras averaging 4.6 mm. wide.

5. *B. ALBA* L. Sp. Pl. 982 (1753), in part; emend. Roth, Tent. Fl. Germ. i. 404 (1788); Schneid. Handb. Laubholz. i. 116 (1904); Rendle & Britten in Journ. Bot. xlv. 441 (1907). *B. alba*, α . *vulgaris* Ait. Hort. Kew. iii. 336 (1789). *B. pubescens* Ehrh. Beitr. v. 160 (1790), *nomen only*, vi. 98 (1793—on title page as 1791). *B. tomentosa* Reitter & Abel, Beschr. und Abbild. Deutschl. selt. wild. Holz.-Art. 17, t. 15 (1803).—Introduced from Europe; naturalized on roadsides, in thickets and at borders of woods, Newfoundland to Pennsylvania, west to Michigan.

Although this characteristic European species is passing in this country as *B. pubescens* Ehrh. (1793) it is clear, I think, that

we should retain for it the name *B. alba* L. (1753), as emended by Roth (1788) and as taken up by Aiton (his var. *vulgaris*, as opposed to his var. β . *pendula*). Roth properly split the bipartite *B. alba* of Linnaeus in 1788 into what he considered true *B. alba* and the newly segregated *B. pendula*. Except to those who, following the very simple but also very doubtful Germanic practice of rejecting all Linnean names of European species if they included what are now considered two or more species, the case seems quite clear. *B. alba* in the sense of Roth, who first made the split, and of Aiton, who, the next year, split the species into its two primary elements (as varieties) was thus retained by those very keen students of nomenclature, Schneider in Vienna and Rendle & Britten in London.

If we should apply to North American species of Linnaeus the Germanic idea of rejecting all of his names, which were used for two or more specific elements but which Linnaeus supposed to be conspecific and to both of which the original Linnean name has been frequently applied, the havoc would be amazing and futile. An embarrassingly large number of the American species of Linnaeus, to say nothing of Old World species from the Orient, were hopeless confusions. Nevertheless, we try to typify them by singling out the element most definitely seeming to be what he primarily intended; or we accept the first clear breaking of the mixture into its primary elements. In case of *Betula alba* the bipartite species was clearly separated into its two primary elements by Roth in 1788. Unless someone earlier segregated them under different names, Roth's typification of *B. alba* should stand.

The name *Betula tomentosa* and that of one of its authors, Reitter (or Reiter) have made endless trouble for those who merely compile from others rather than check the original sources. Thus, from the statement in Dippel, Handb. Laubholzk. ii. 174 (1892), a work in which the illustrations (and apparently the bibliography), right or wrong, were copied from others, we find under *B. alba*, subsp. *pubescens* the following bibliography: "Bet. pubescens Ehrh. Beitr. z. Naturk. VI. S. 98. 1793. . . . Bet. tomentosa Reitter u. Abel Abbild. d. 100 wild. deutsch. Holzart. I. 17. 1790." If Dippel's bibliography were correct, the name *B. tomentosa* ("1790") would obviously antedate *B.*

pubescens (1793). This, however, is not the case. It is simply one of the many errors which the incorrect citations of Reitter & Abel have started.

In the first place, the name of the first of the two authors has been so misinterpreted that one wonders if later authors have ever taken the trouble to look up the books. Thus, in *Index Kewensis* he appears as Retz[ius]. Von Hayek, *Fl. Steyerm.* i. 105 (1908), swallowed without evident choking the predigested date, 1790, and displaced *B. pubescens* (1793) by *B. tomentosa* "REITH et ABEL"; and Schneider, *Ill. Handb. Laubholz.* ii. 886 (1912) also said "REITH et ABEL". Ascherson & Graebner, *Syn.* iv. 398, got nearer the facts as to the first author but by omitting a period made the authors and the place of publication erroneously appear as "Reitt u. Abel Abb. 100 wild. Holzart. I. 17 (1790)." Even the very careful *Bradley Bibliography* called them Reiter & Abel in vol. i. 370, but one looks in vain for them under Reiter in the *Index*, for there (vol. iv. 716) they are entered only under Reitter.

The author himself (or his editors, collaborators or publishers) was doubtful as to his own name. There were two quite different books by the pair of authors. In the citations by later authors these have been hopelessly confused. These books were

1. *Abbildung der Hundert deutschen wilden Holz-Arten, etc.* Stuttgart. 1790. With colored plates. The authors given as Reitter und Abel and the first author's name spelled in the dedication very definitely "Reitter". The somewhat altered second edition, with the dedication and much of the introductory matter omitted, the plates uncolored, came out in 1805. Here he appears as "Reiter".
2. *Beschreibung und Abbildung der in Deutschland seltener wildwachsenden und einiger bereits naturalisirten Holz-Arten, etc.* Stuttgart. 1803. The authors given as Reiter und Abel.

No. 1 alone was caught by Pritzel's *Thesaurus*. Since no. 2 was evidently unknown to Pritzel it must be very rare. I have, fortunately, been able to consult them both, as well as the 2nd edition of no. 1, at the Arnold Arboretum; and the Librarian, Mrs. Schwarten, kindly refers me to the biography of Johann Daniel REITTER in Hess, *Lebensbilder*, 287 (1885), the biographer there listing book no. 1, *Abbild. Hundert deutsch. wild. Holz-Art.*, but not no. 2, *Beschreib. und Abbild. Deutschl. Holz-Art.* Now, when both these works are examined it will be found that in no. 1, *Abbild. Hundert deutsch. wild. Holz-Art.*, there is no

Betula tomentosa. The only true Birch there is on p. 7 (not 17), "XV. Kupfertafel. Die Birke. Wonnerbaum. *Betula alba*"; while plate 15 has merely the text "*Betula alba. Die Birke*". Dippel, von Hayek and others who have started *B. tomentosa* there have obviously been mistaken.

In work no. 2, Beschr. und Abbild. 17 (1803) there is a detailed account of *Betula tomentosa*, the "wohlriechende Birke" and t. 15 shows it in color, also as *B. tomentosa*. That, however, was in 1803, not in 1790, so that for those who maintain *B. pubescens* as a species the name *B. tomentosa* offers no competition. The rarity of Reitter & Abel's Beschr. und Abbild. (1803) is further indicated by the absence of a reference to its plate 15 in Index Londinensis. Plate 15 of the Abbildung (1790) is there correctly cited under *B. alba*.

6. *B. PAPYRIFERA* Marsh. Arb. Am. 19 (1775). *B. papyracea* Ait. Hort. Kew. iii. 337 (1789). *B. alba*, δ . *papyrifera* Spach in Ann. Sci. Nat. Bot. sér. 2, xv. 188 (1841); Regel in Nouv. Mém. Soc. Sci. Nat. Mosc. xiii. 81—repr. Mon. Bet. 23—t. v. fig. 5–16 (1861). *B. alba* sensu Fernald in Am. Journ. Sci. ser. 4, xiv. 169 and 190, in small part (1902).—Highly variable; represented in eastern North America by the following varieties and forms,

- a. Leaves merely rounded to tapering at base. . . . b.
- b. Bracts of pistillate aments 3-lobed; peduncle usually shorter than fruiting ament; the latter 2.5–6.5 cm. long. . . . c.
- c. Mature fertile bracts 3.5–7 mm. long, with divergent lateral lobes; samaras 3.5–5 mm. broad. . . . d.
- d. Branchlets spreading or ascending, not strongly drooping; leaves of fertile branches broadly ovate, mostly rounded at base; pistillate aments mostly solitary on the spurs. . . . e.
- e. Bark of trunks of fruiting trees (or shrubs) creamy-to pinkish-white, very soon exfoliating.
Leaves membranaceous to firm, hardly lustrous
B. papyrifera (typical).
- Leaves thick and leathery, lustrous above. . . . Forma *coriacea*.
- e. Bark of fruiting trunks warm-brown, only on oldest bases with smooth outer brown layer exfoliating
Var. *commutata*.
- d. Branchlets pendulous; leaves of fertile branches narrowly ovate to ovate-lanceolate, only slightly rounded to gradually tapering to petiole; pistillate aments often in fascicles of 2–4 on the spurs. . . . Var. *pensilis*.
- c. Mature fertile bracts 7–10 mm. long, with ascending lateral lobes; samaras 6–8 mm. broad; leaves ovate, with rounded bases; fruiting aments solitary or paired.
Peduncles of fruiting aments 0.5–1.5 cm. long, many times shorter than ament. . . . Var. *macrostachya*.
- Peduncles 2–3 cm. long, one half to essentially as long as pendulous ament. . . . Forma *longipes*.

- b. Bracts unlobed or with merely rudimentary lateral lobes, elliptic-oblong; pistillate aments 1.5–2 cm. long, about equaled by arched-recurving peduncle; leaves rhombic-oval, dentate. Var. *elobata*.
- a. Leaves definitely cordate at base; bracts of mature pistillate aments 5–10 mm. long, mostly with ascending lobes; bark of mature trunks warm-brown to creamy- or pinkish-white. Var. *cordifolia*.

B. PAPYRIFERA, typical.—Woods, especially on slopes, Labrador to Alaska, south to Newfoundland, Nova Scotia, New England, New York, upland of Pennsylvania and West Virginia, northern Ohio, northern Indiana, northern Illinois, northern Iowa, South Dakota, etc. PLATE 964.

Forma **CORIACEA** Fernald & Wiegand in RHODORA, xxv. 209 (1923)—Dunes of Lake Ontario, New York.

Var. **commutata** (Regel), comb. nov. *B. occidentalis* Hook. Fl. Bor.-Am. ii. 155 (1839) as to specimen from *Scouler* only, not as to other specimens and detailed description; sensu Lyall in Journ. Linn. Soc. vii. 134 (1864); sensu Sargent in Bot. Gaz. xxxi. 237 (1901); not Hook. l. c. as to detailed descr. (1839), nor Nutt. N. A. Syl. i. 23, pl. 7 (1853), nor S. Watson in Bot. King Report—U. S. Geol. Expl. 40th Parallel, v. 323, pl. xxxv (1871), nor Sargent, Sylva, ix. 65, pl. cccclv (1896), nor S. Wats. Bot. Calif. ii. 79 (1880). *B. alba*, subsp. *occidentalis* (Hook.) Regel, β . *commutata* Regel in Bull. Soc. Nat. Mosc. xxxviii. 401 (1865)—repr. as Bemerk. Gatt. Bet. Aln. 14, pl. 7, figs. 6–10 (1866) and in DC. Prodr. xvi². 166 (1868), as to TYPE from Sumass Prairie, Lyall. *B. papyracea*, var. *occidentalis* sensu Dippel, Handb. Laubholzk. 177 (1892). *B. Lyalliana* Koehne in Mitt. Deutsch. Dendr. Gesellsch. 1899: 53 (1899), *nomen only*. *B. alba*, forma *occidentalis* sensu Fernald in Am. Journ. Sci. ser. 4, xiv. 173 and 190 (1902), not *B. occidentalis* Hook. basonym. *B. papyracea* *Lyalliana* Koehne ex Schelle in Beisner, Schelle & Zabel, Handb. Laubh.-Ben. 55 (1903). *B. papyrifera*, var. *Lyalliana* (Koehne) Schneid. Ill. Handb. Laubhk. i. 115 (1904), based on “*B. occidentalis* LYALL, in Jour. Lin. Soc. VII. 134. 1864, ex parte, non Hook.” *B. papyrifera*, var. *occidentalis* sensu Sargent in Journ. Arn. Arb. i. 63 (1919), not *B. occidentalis* Hook. basonym.—Woodlands near the coast, Labrador to northeastern Massachusetts; western North America south to Oregon. PLATE 965.

In 1902 I pointed out that the character of permanently close and dark bark, which Sargent (1901) took as the single *specific* character of the tall tree of the Pacific slope, “perhaps the largest of all birch-trees” (Sargent, l. c. 238), breaks down in the West and that in the East trees, otherwise inseparable from *B. papyrifera*, may have the bark permanently quite as dark as in the tree

of Puget Sound and the lower Fraser River. Subsequently I have seen forests in Newfoundland and at the tip of the Gaspé Peninsula where the large trunks (up to 9 dm. in diameter) were covered with smooth deep-brown bark. In the oldest trees, however, the dark bark of the base of the trunk (up to 2 or 3 m.) will sometimes exfoliate and there leave perfectly characteristic exfoliating pale bark (PLATE 965, FIGS. 2 and 3) of typical *B. papyrifera*. One of the southernmost stations in the East seems to be on Cape Ann, large brown-barked shrubs loaded with fruit, near granite-quarries back of Bayview, Gloucester, where it was collected in August, 1944, by Miss Elizabeth Johnston. It might be thought that it was long ago recorded from Essex County, for the three specimens cited by Regel of his *B. alba*, subsp. *occidentalis*, β . *commutata* were from "Sumass Prairie (Lyall), Topsfield, Massachusetts (Asa Gray), Oregon (Lyall). The Topsfield specimen, labelled by Regel as above, was distributed by William Oakes as *B. papyracea*; Asa Gray merely sent it on loan to Regel. There is no note regarding the bark of the trunk; apparently Oakes did not see anything unusual in it. The Lyall specimen from Sumass Prairie is the TYPE of var. *commutata*.

Hooker, Nuttall, Torrey, Sereno Watson and many other careful students of the past correctly understood Hooker's rather vivid description of *Betula occidentalis*. Unfortunately, however, Hooker originally complicated matters by first citing a specimen from "Straits of De Fuca. Dr. Scouler", although his description was, it seems to me and to several field-botanists who know both trees, based almost entirely on the characteristic shrub or small tree of the Rocky Mountain region, west to the drier slopes of British Columbia, Washington, Oregon and California, the species which Sargent, l. c. 239 (1901) renamed *B. fontinalis*. These two trees are abundantly distinct but I am unable to follow Sargent's reasoning, except that in 1901 he was following the now abundantly discredited principle of neglecting, if it happened to disagree, the description and taking as type the first cited specimen, in this case the Scouler specimen from the Straits of Juan de Fuca. In doing so, however, he saw in Hooker's description more elements of that species than I can find and consequently set off the cordilleran *B. fontinalis*. He

stated that the specimens cited by Hooker came from three different trees:

First, *Betula papyrifera* Marsh . . .

Second, the large tree which grows on the lower Fraser river, on the shores and islands of Puget sound, and on Vancouver island (PLATE 965, FIGS. 1 and 4-6). This tree has . . . pubescent branchlets, . . . leaves pubescent on the lower surface, . . . Specimens of this tree, which is perhaps the largest of all birch-trees, were first gathered on the shores of the straits of Fuca by Dr. John Scouler . . . The tree from the straits of Fuca appeared first in the description of *Betula occidentalis* which was evidently drawn principally from the specimen of that tree [italics mine], and must be considered the type of Hooker's species . . .

Third, the half-shrubby dark-barked species . . . which ranges as far south as Colorado, Utah, and northern California. This plant was collected by Nuttall on the Sweetwater . . . and was first described and figured by him as *Betula occidentalis* (*Sylva* I: 23. pl. 7). Torrey in the *Botany of Fremont's Expedition* repeats this error. This same species was also described and figured in *King's Rep.* (5: 323. pl. 35) as *Betula occidentalis* by Watson who repeated his error in the *Botany of California*, and it . . . is described and figured as *Betula occidentalis* in my ninth volume of *The Sylva of North America* . . . our tree, for which I now propose the name of ***Betula fontinalis***.

Along with many others I have fallen into the trap and have followed Sargent in calling the cordilleran low tree or coarse shrub *Betula fontinalis*. This course, as already stated, ignores the very definite description given by Hooker:

3. *B. occidentalis*; ramis rufo-fuscis copiose resinoso-verrucosis, foliis late rhombeo-ovatis sublobatis grosse inciso-serratis sub lente appresso-hirsutulis v. nudis subtus pallidioribus epunctatis, nervis paucis remotis, amentis foem. lato-cylindraceis, squamis lobis ovato-oblongis lateralibus decurvo-falcatis intermedio longiore.

HAB. Straits of De Fuca. Dr. Scouler. Near springs on the west side of the Rocky Mountains. Douglas; and on the east side, from the mountains to Edmonton House. Drummond. One specimen is in the collection from the Arctic coast* (?) Dr. Richardson—This Birch does not agree with any described species, and it is probably confined to the west coast, and to the immediate vicinity of the Rocky Mountains, forming a low, small brush-wood, 6-10 feet high, and never exceeding a few inches in the diameter of its trunk. Mr. Drummond considered it to be the *B. nigra*, but its bark and leaves are quite different; [Then a statement of characters of *B. nigra*]. The main branches are erect, and somewhat virgate, clothed with a red-brown bark, a little inclining to purple, copiously sprinkled with resinous warts in all the specimens. Petioles $\frac{1}{2}$ to $\frac{3}{4}$ of an inch long, adult leaves 2-2 $\frac{1}{2}$ inches, broadly ovato-rhomboid, rather acute than acuminate, of a harsh and dry but not thick texture, slightly lobed at the margin, and inciso-serrate, the serratures coarse and sharp, paler beneath, but never, either in the old or younger state, dotted. Male catkins resembling those of the preceding [*B. papyrifera*], 1-2 inches long.

* There has probably been some mistake in the station of this."

In the two following paragraphs I have quoted the characters as described by Sargent, Man. 204, 205 and 207 (1905) and by Rydberg, Fl. Rky. Mts. 202-204 (1918) of *B. occidentalis* sensu Sargent (i. e. *B. papyrifera*, var. *commutata*) and *B. fontinalis* Sargent (i. e. *B. occidentalis* Hook.); and after each item Hooker's own description in italics. As Bateson used to say, a judicious advocate leaves the conclusion to flow quietly from the evidence.

B. OCCIDENTALIS sensu Sargent (i. e. *B. PAPYRIFERA*, var. *COMMUTATA*). "A tree, 100°-120° high, with a trunk 3°-4° in diameter" (Sargent); "tree sometimes 30-40 m. high" (Rydb.). HOOKER: "*small brush-wood, 6-10 feet high, and never exceeding a few inches in the diameter of its trunk*". The "branches often pendulous on old trees, . . . branchlets more or less glandular and coated with long pale hairs when they first appear, . . . marked by numerous minute pale lenticels and pubescent or puberulous during their first winter and nearly destitute of glands" (Sargent); "at first pubescent or puberulent" (Rydb.). HOOKER: "*ramis . . . copiose resinoso-verrucosis*", "*The main branches erect, and somewhat virgate, . . . copiously sprinkled with resinous warts on all the specimens*". Leaves "ovate, acute, . . . covered with dark reddish resinous viscid glands, and villous along the mid-ribs and veins, with long white hairs often also in large persistent tufts in the axils of the primary veins, and at maturity thin and firm in texture, marked by the scars of the fallen glands, . . . 3'-4' long, . . . their petioles stout, glandular, at first tomentose, ultimately pubescent or puberulous, about $\frac{3}{4}$ ' long" (Sargent). HOOKER: "*foliis late rhombeo-ovatis . . . sub lente appresso-hirsutulis v. nudis subtus . . . epunctatis*" . . . "Petioles $\frac{1}{2}$ to $\frac{3}{4}$ of an inch long, adult leaves 2-2 $\frac{1}{2}$ inches, broadly ovato-rhomboid, rather acute than acuminate, of a harsh and dry but not thick texture, . . . paler beneath, but never, either in the old or younger state, dotted". The "staminate aments . . . becoming 3'-4' long" (Sargent). HOOKER: "*Male catkins . . . 1-2 inches long*".

B. OCCIDENTALIS sensu Nuttall, Torrey, Sereno Watson and Sargent's Sylva (i. e. *B. FONTINALIS* Sargent): "more commonly shrubby, with many thin spreading stems forming open clusters, 15°-20° high; often much lower, and frequently crowded in almost impenetrable thickets" or more rarely "A tree, occasionally 30°-40° high, with a trunk 12'-18' in diameter" (Sargent); "tree occasionally 10-12 m. high, often growing in clumps and shrub-like" (Rydb.). HOOKER: "*forming a low, small brush-wood, 6-10 feet high, and never exceeding a few inches in the diameter of its trunk*". Branchlets "much roughened at first by large lustrous resinous glands persistent until the second season" (Sargent); "twigs densely glandular-resiniferous", "not hairy" (Rydb.). HOOKER: "*ramis copiose resinoso-verrucosis*", "*branches . . . copiously sprinkled with resinous warts in all the specimens*". Leaves "broadly ovate, acute" with "abruptly wedge-shaped . . . base, and sometimes slightly laciniately lobed, . . . pilose above, and covered by conspicuous resinous glands when they unfold, at maturity thin and firm, . . . 1'-2' long, . . . petioles . . . $\frac{1}{3}$ '- $\frac{1}{2}$ ' long" (Sargent); "leaves broadly ovate, usually less than 4 cm. long" (Rydb.). HOOKER: "*foliis late rhombeo-ovatis sublobatis grosse inciso-serratis sub lente appresso-hirsutulis v. nudis subtus . . . epunctatis*", "*petioles $\frac{1}{2}$ to $\frac{3}{4}$ of an inch long, adult leaves 2-2 $\frac{1}{2}$ inches, broadly ovato-rhomboid, rather acute than acuminate, of a harsh and dry but not thick texture, slightly lobed at the margin, . . . never, either in the old or younger state, dotted*". Staminate "aments . . . becoming 2'-2 $\frac{1}{2}$ ' long" (Sargent); "staminate aments 5-7 cm. long" (Rydb.). HOOKER: "*Male catkins . . . 1-2 inches long*".

When we take into account the facts that plenty of mature branches of *Betula occidentalis* (*fontinalis*) have leaves down to $\frac{3}{4}$ inch long and petioles down to less than $\frac{1}{4}$ inch in length, while others (*Koehne*, Herb. Dendrol. no. 105; *L. E. Smith*, no. 759; *Muenschner & Maguire*, no. 15,690; *M. E. Peck*, no. 9468; *F. A. Walpole*, no. 323; *Eggleston*, no. 21,998; *St. John*, no. 7655; show blades 2–2½ inches long, while in an extreme variety they may be up to 7 cm. long, it becomes quite clear that in most of his stated characters Hooker was accurately describing the relatively low and often shrubby species which Nuttall, Torrey, Watson and others understood as *B. occidentalis* and which Sargent, without any concrete diagnosis and without designation of type, called *B. fontinalis*.

Returning to *Betula papyrifera*, var. *commutata*, that name started as *B. alba*, subsp. *occidentalis*, var. β . *commutata* Regel in 1865, Regel defining his subsp. *occidentalis*, var. α . *typica* "trunco humili, foliis inciso-sublobatis dentatisque" (i. e., following Hooker's original description), while his var. *commutata* was defined as follows:

β *commutata* (tab. 7, fig. 6–10); trunco elato; foliis duplicato-dentatis.—Als *B. papyracea* und *papyrifera* im Herbarium Asa Grays und Boissiers.—Wächst in Nord-amerika, Sumass Prairie (Lyall), Topsfield, Massachusetts (Asa Gray), Oregon (Lyall).

Von der folgenden Unterart [*papyrifera*] nur durch die gespreizten oder zurück gekrümmten Seitenlappen der Schuppen des Fruchtzäpfchens verschieden.

All three sheets, including the TYPE from Sumass Prairie are before me. In all evident characters they are quite like the tree of the Pacific slope which Sargent took as *B. occidentalis* and they are all easily matched in details by much eastern *B. papyrifera*. The tree of the Fraser River region, including Sumass Prairie, is with reasonable certainty the dark-barked variety, but the Topsfield specimen of William Oakes (not Asa Gray) is, as already explained (p. 313) evidently from the pale-barked and generally commoner eastern *B. papyrifera*. In Lyall's account of "The Lower Fraser River district, which includes the Sumass and Chilukweyuk prairies and other low grounds to the westward of the Cascade Mountains—a moist region", Lyall, in Journ. Linn. Soc. Lond. vii. 131–135 (1864), enumerated from "The banks of the Lower Fraser River . . . *Abies Douglasii*, . . .

Abies Menziesii, . . . *Abies Mertensiana*, . . . *Thuja gigantea*, . . . *Acer macrophyllum*", etc. and then "*Betula occidentalis*, Hook. (a tree growing to the height of 60 or 70 feet [compare Sargent's "100°–120°", also J. K. Henry's "A small or large tree"] and most common about the borders of the forest)". That material was the basis of var. *commutata*. When Schneider published his *B. papyrifera*, var. *Lyalliana*, citing the Lyall account above quoted and the synonym *B. occidentalis* sensu Sargent, not Hooker, he evidently overlooked the earlier name which had been based on the Lyall collections.¹

¹ The reinstatement of *Betula occidentalis* Hook. necessitates the following new varietal name.

B. OCCIDENTALIS Hook., var. *fecunda*, nom. nov. *Betula*, 3d. described tree in Piper & Beattie, Fl. Palouse Reg. 55 (1901). *B. Piperi* Britton in Bull. Torr. Bot. Cl. xxxi. 165 (1904), as to description, not as to single collection cited. *B. fontinalis*, var. *Piperi* (Britton) Sargent in Journ. Arn. Arb. i. 65 (1919), in part only. PLATE 966.

In their Flora of the Palouse Region Piper & Beattie, with well-understood hesitation, refrained from assigning guesswork names to the three birches of the area. Instead, they described the three in detail but without names. Their third tree was

"B. Graceful tree, 8–15 m. tall, with drooping branches: bark dark bronze . . . branchlets . . . very glandular; leaves ovate, obtuse or acute at the base, . . . shining green above, glandular on both surfaces, 2–4 cm. long . . . pistillate aments cylindrical: 5 cm. long, .5 cm. thick, often flexuous, mostly in twos, . . . Springy hillsides near Almota."

This description was but slightly, though somewhat, changed by Britton, whose *B. Piperi* was the "tree . . . described by Professor Piper as attaining a height of 15 m. and being slender and graceful, with drooping branches" &c., largely a rewriting of the Piper & Beattie description above quoted. But, most unfortunately, the locality of the "Graceful tree, 8–15 m. tall, with drooping branches", "Springy hillsides near Almota", was not given. Instead, Britton cited only a single station: "Type collected by Professor C. V. Piper, July 9, 1901, nine miles south of Pullman, Washington", with the sad result that Piper himself, accepting for the tree which I am calling *B. papyrifera*, var. *commutata* Sargent's misidentification of it as *B. occidentalis* Hook., was forced to reduce *B. Piperi* to its synonymy. Piper's statement follows: "The name *Betula piperi* was meant by its author to apply to the third unnamed species in the Flora of the Palouse Region, but the specimen actually cited is the eastern Washington form of *B. occidentalis* Hook."—Piper, Fl. Wash., Contrib. U. S. Nat. Herb. xi. 218 (1906).

Var. *fecunda* (PLATE 966) is a remarkably definite variety of the western *Betula occidentalis* (*fontinalis*). In its pendulous branches with the tendency to fascicled and slender aments it is strikingly unlike the shrubby and virgate-branched *B. occidentalis* of Hooker's original description, in which the shorter aments are mostly solitary on the spurs. The latter has been so often illustrated that I am here showing only var. *fecunda*. Piper, puzzled by this beautiful tree, sent, unnamed, 14 sheets (under several numbers) to the Gray Herbarium. These were mostly misidentified by me as the Asiatic *B. microphylla*. Under this misidentification of mine Piper in his Flora of Washington, p. 219, wrote: "The Almota specimens form the basis for the third unnamed species in the Flora of the Palouse Region. This is a tall graceful tree with drooping branches, appearing very different from the ordinary form of *B. microphylla*, and probably distinct from it." As TYPE of var. *fecunda* I am designating Piper, no. 1642 in the Gray Herbarium.

Although the leaves of var. *fecunda* were described by Piper as 2–4 cm. long, his material was all rather young. Material from slightly to the southwest, Columbia Co., St. John, Davison & Scheibe, no. 6939, has leaves 5–7 cm. long.

Var. **pensilis**, var. nov. (TAB. 967), ramulis pendulis; foliis angusto-ovatis vel ovato-lanceolatis basin versus plerumque angustatis vel vix rotundatis; amentis foemineis solitariis vel 2-4-fasciculatis; bracteis 5.5-7 mm. longis, lobis lateralibus rhomboideis vel late oblongis divergentibus. *B. alba* var. *glutinosa* sensu Fernald in Am. Journ. Sci. ser. 4, xiv. 176 (1902), not Trautv.—Locally abundant, Newfoundland to western Quebec, south to Nova Scotia, Maine, Massachusetts and northern New York. NEWFOUNDLAND: high tableland, Holyrood, Aug. 1, 1931, *Agnes M. Ayre*; Buchan Junction, July 19, 1930, *K. P. Jansson*. QUEBEC: Rivière du Brick, Anticosti, *Victorin & Rolland*, no. 27,773; thickets and borders of woods near mouth of Marsouin River, Gaspé Co., *Fernald & Pease*, no. 25,017; head of l'Anse aux Bouleaux, Bic, Rimouski Co., July 6-10, 1905, *Williams, Collins & Fernald*; Bic, July 17, 1905, *J. R. Churchill*; east side of Lac Tremblant, Terrebonne Co., July 21, 1922, *Churchill*; near Georgeville, Lake Memphremagog, Aug. 12, 1914, *Churchill*. NOVA SCOTIA: "small tree 10 ft. high, branches drooping", banks of Lahave R., Bridgewater, *J. G. Jack*, no. 3510. MAINE: tree by road to Leighton Pond, Pembroke, July 10, 1909, *Fernald* (TYPE in Herb. Gray.); by Wassataquoik River between Roebar's and Dacy Dam, Piscataquis Co., July 17, 1900, *Fernald*. MASSACHUSETTS: large tree by Charles River, Newton Lower Falls, July 23, 1912, *Wiegand*. NEW YORK: banks of Cascade Lakes, Essex Co., *House*, no. 7640; mountain-side, alt. 1800 ft., near Minerva, Essex Co., *House*, no. 14,887; Stony Island 2, west end of Black Lake, St. Lawrence Co., *Muenschner & Maguire*, no. 2168.

Var. *pensilis* is very striking, not only as a "weeping" birch but on account of the mostly acute-based leaves and the very abundant fruiting aments. In 8 of the sheets before me they are often clustered on the spurs in fascicles of 2-4.

Var. **macrostachya**, var. nov. (TAB. 968, FIG. 1-3), ramulis divergentibus vix pendulis; foliis ovatis basi rotundatis; amentis foemineis solitariis vel binis, maturis 3.5-5.5 cm. longis 1-2 cm. crassis pedunculatis; pedunculis arcuato-recurvatis 0.5-1.5 cm. longis; bracteis 7-10 mm. longis, lobis lateralibus rhomboideis porrectis vel adscendentibus; samaris 6-8 mm. latis.—Local, northern Newfoundland to Rimouski County, Quebec, south to Nova Scotia and northern Maine. NEWFOUNDLAND: rich thickets on lower slopes of Ha-Ha Mt., Ha-Ha Bay, *Fernald, Wiegand, Long, Gilbert & Hotchkiss*, no. 28,065; thickets and glades, slopes of Cape Dégrat, Quirpon Island, Straits of Belle Isle, *Fernald & Long*, no. 28,067. QUEBEC: cold northerly calcareous walls of Grande Coupe, Percé, Gaspé Co., *Fernald & Collins*, no. 1000; bois près de la mer, Bic, Rimouski Co., *Victorin & Rolland*, no. 49,461. NOVA SCOTIA: dry mixed woods, Hecta-

nooga, Digby Co., July 31, 1920, *Long & Linder*, no. 21,007 (TYPE in Herb. Gray.; ISOTYPE in Herb. Phil. Acad.). MAINE: in disintegrated volcanic rock, Haystack Mt., Aroostook Co., July 11, 1902, *Williams, Collins & Fernald*.

In its very large aments, bracts and samaras var. *macrostachya* stands midway between typical *Betula papyrifera* and var. *cordifolia*. It is also intermediate in the tendency of its pistillate bracts to have the porrect lateral lobes of the latter, but sometimes nearly or quite horizontal as in the former. Its leaves are like those of typical *B. papyrifera*, without the cordate base so characteristic of var. *cordifolia*. Were it not for this transitional var. *macrostachya*, it would be reasonable to look upon var. *cordifolia* as a fairly distinct species, the status originally given it by Regel.

Var. MACROSTACHYA, forma **longipes**, f. nov. (TAB. 968, FIG. 4), pedunculis 2–3 cm. longis, amentis fructiferis pendulis.—Gaspé Peninsula, QUEBEC: woods, Malbaie, Gaspé Co., *Pease*, no. 6025A, as var. *cordifolia*; mossy meadows and woods at 455 m. (1500 ft.)—915 m. (3000 ft.) in the great basin [Fernald Basin] under the north slope of Mt. Logan, Matane Co., July 22, 1922, *Fernald & Pease*, no. 25,019 (TYPE in Herb. Gray.).

Very striking in its long drooping peduncles often essentially as long as the pendulous aments.

Var. ELOBATA (Fernald) Sargent in Journ. Arn. Arb. i. 63 (1919). *B. alba*, var. *elobata* Fernald in RHODORA, xv. 169 (1913).—Known only from the type-locality in QUEBEC: crevices and talus of serpentine along Ruisseau à la Neige, Mt. Albert, Gaspé Co., *Fernald & Collins*, no. 531. PLATE 969.

It is not improbable that var. *elobata*, when mature fruiting material is secured, may prove to be an endemic species. In its subrhombic and dentate leaves, suggestive of those of *B. nigra* L., and in its very short pendulous pistillate aments with unlobed or only obsoletely lobed bracts, it is very distinct. Unfortunately, the material, collected in an alpine area and only slightly past anthesis in July, does not show mature samaras. The type-colony is near the head of one of the northwestern tributaries of Ruisseau à la Neige, as it abruptly descends the cañon-wall, not far below the serpentine tableland (alt. about 3500 ft.). Under it grow *Polystichum mohrioides*, var. *scopulorum* (D. C. Eaton) Fernald, in its only known area east of local stations in Idaho, while close-at-hand are the type-areas of the endemic or near-

endemic *Salix chlorolepis* Fernald, *S. hebecarpa* Fernald, *Arenaria marcescens* Fernald and *Solidago chlorolepis* Fernald, and endemic or disjunct varieties in *Salix*, *Statice* and *Cnicus*. It is important to secure the fruit of *Betula papyrifera*, var. *elobata*.

Var. CORDIFOLIA (Regel) Fernald in RHODORA, iii. 173 (1901), by inference only; Rehder, Man. Cult. Trees and Shrubs, 141 (1927). *B. cordifolia* Regel in Nouv. Mém. Soc. Nat. Mosc. xiii. 86—repr. as Mon. Bet. 28, t. 12, figs. 29–36 (1861). *B. alba*, subsp. *papyrifera*, β . *cordifolia* (Regel) Regel in Bull. Soc. Nat. Mosc. xxxiii. 401 (1865)—repr. as Bemerk. Gatt. Bet. Aln. 14 (1866) and in DC. Prodr. xvi². 166 (1868). *B. papyracea*, a *cordifolia* (Regel) Dippel, Handb. Laubholzk. ii. 177 (1892). *B. alba*, var. *cordifolia* (Regel) Fernald in Am. Journ. Sci. ser. 4, xiv. 177 and 190 (1902). *B. papyracea cordifolia* (Regel) Scheele in Beisn., Scheele & Zabel, Handb. Laubh. Benen. 55 (1903). *B. papyrifera*, var. *communis*, f. *cordifolia* (Regel) Schneid. Handb. Laubholzk. i. 115 (1904).—Labrador to Algoma District, Ontario, south to Newfoundland, Nova Scotia, New England (rare southward), northern New York, Michigan, Wisconsin and northern Iowa; high altitudes on Blue Ridge, North Carolina. PLATE 970.

In its firm and definitely cordate leaves, its long bracts with mostly porrect lobes and its large samaras *Betula papyrifera*, var. *cordifolia* might merit the specific rank originally given it by Regel; but, as already noted, var. *macrostachya*, with leaves merely rounded and not cordate at base, exactly bridges the gap between it and typical *B. papyrifera*. With its very long bracts with mostly porrect (instead of horizontally divergent) lobes it is certainly a well marked geographic variety, which in the western half of the continent is replaced by var. *subcordata* (Rydb.) Sargent. Rare in southern New England and not known south of the Adirondack region in New York, this is the only variety of *B. papyrifera* known on the high mountains of North Carolina. In discussing its discovery and abundance at 5500–6200 ft. altitude, “in the spruce and balsam forest”, “about 550 miles” south of its supposed southern limit (in Massachusetts and Connecticut), Ashe in RHODORA, xx. 63, 64 (1918) quoted various northern botanists, some of whom (Britton and Blanchard) regarded it a good species, others (Sargent and Burns, besides the present writer) recognizing intergradient trees; and he concluded: “The fact that the cordate [-leaved] form alone occurs in North Carolina, and that there its leaf-form is strongly marked and

without indication of variation—foliage was examined from more than 100 trees—would at least seem to give it excellent varietal if not specific characterization.”

In his original publication of *Betula cordifolia* Regel cited it as in “Novaja Semlaja von Hr. de la Tylaie im Jahre 1826 gesammelt” and compared it with the Asiatic *B. Ermani* Chamisso, arguing for its specific separation since “dass *B. Ermani* bis jetzt aus Novaja Semlaja noch nicht bekannt ist”. Bearing in mind that Novaja Semlaja is the Russian equivalent of Terre-neuve, where Bachelot de la Pylaie (not “Tylaie”) spent so many years in botanizing, the intent is obvious. In fact, Regel got the type-locality straightened in his later treatments, where he correctly gave it as “Terra nova (de la Pylaie . . .).”

A small-leaved northwestern variety of *Betula papyrifera*, which may be expected to cross the plains into Minnesota, has leaves in outline resembling those of *B. pendula*. This is

B. PAPHYRIFERA Marsh., var. **humilis** (Regel) Fernald & Raup, comb. nov. *B. alba*, subsp. *papyrifera*, var. γ *humilis* Regel in DC. Prodr. xvi. 166 (1868), in part (descr. and Bourgeau specimen from Saskatchewan). *B. alaskana* Sargent in Bot. Gaz. xxxi. 236 (1901), not Lesq. (1883). *B. neoalaskana* Sarg. in Journ. Arn. Arb. iii. 206 (1921). *B. papyrifera*, var. *neoalaskana* (Sarg.) Raup, Contrib. Arn. Arb. vi. 152 (1934). PLATES 971 and 972.

Betula alba, subsp. *papyrifera*, γ . *humilis* was based primarily on a sheet in the Gray Herbarium, collected by Bourgeau in 1857–8 in Saskatchewan (“Bords de la rivière Castor”). This sheet (our PLATE 971, FIGS. 1–4) bears Regel’s annotation. Although Regel followed this with citation of Parry and Hall & Harbour specimens, which are of *B. occidentalis* Hook. (*B. fontinalis* Sarg.) and the type of Tuckerman’s *B. papyracea*, var. *minor* (*B. minor*) from the White Mts., his description, “folia . . . juniora petiolique saepe pubescentia, . . . subtus ad nervos tantum pilosula. Samararum alae nucula usque triplo latiores”, definitely applies to the Bourgeau sheet. It can not apply to *B. minor*, for the branchlets and leaves of that more eastern shrub are strictly glabrous and the wings of its samaras are never “nucula usque triplo latiores”. Nor could the glabrate branches of Regel’s “Ramuli . . . glanduliferi v. juniores pubescentes, dein glabrati” apply to either *B. minor* or *B. occi-*

dentalis, both of which have glabrous branchlets; the "juniores pubescentes, dein glabrati" belongs also to the Bourgeau element. Since this Saskatchewan specimen, clearly labelled by Regel as his *B. alba*, subsp. *papyrifera*, var. *humilis*, agrees with his description in the more diagnostic characters, whereas the Rocky Mountain specimens (*Parry* and *Hall & Harbour*) as well as the White Mountain one (*Tuckerman*) already had legitimate names, we see no way but to take up the name var. *humilis* for the Saskatchewan element primarily described.

There is a second sheet of Bourgeau's Saskatchewan material (1858) in the Gray Herbarium. This one (PLATE 972, FIG. 1) has had a checkered career. In his *Bemerkungen über die Gattungen Betula und Alnus*, Bull. Soc. Nat. Mosc. xxxviii. 398 (1865)—repr. 11 (1866)—Regel published under the strictly Eurasian *Betula alba*, subsp. *verrucosa*, a var. *resinifera*, based exclusively on a Middendorf specimen from eastern Siberia. In DeCandolle's *Prodromus*, xvi². 164 (1868), however, although otherwise holding his *B. alba*, subsp. *verrucosa* strictly to Eurasia, he cited under var. *resinifera* a single North American specimen: "in America boreali-occidentali ad Saskatchewan (Palliser)". This specimen, *Bourgeau*, 1858, on the Palliser Expedition (Gray Herb.), was originally distributed as *B. papyracea* but it bears Regel's annotation as above. A portion of it is shown in PLATE 972, FIG. 1. The significant point in connection with this second *Bourgeau* (*Palliser*) sheet is that Sargent, describing his *B. alaskana*, selected it as the first specimen to be cited under his new specific name: "Saskatchewan, *E. Bourgeau*, 1858 (in Herb. Gray); near Prince Albert in latitude 53, July 1876, *John Macoun* [our PLATE 971, FIG. 5 and 972, FIGS. 2 and 3]; northwestward, reaching the Alaskan coast", etc. Of this *Bourgeau* specimen Sargent wrote: "The specimen in Herb. Gray collected by Bourgeau in flower on the Saskatchewan was referred by Regel (*Bull. Mosc.* 18: 398; *DC. Prodr.* 16²: 164) to his *Betula alba*, subspecies *verrucosa* ♂ *resinifera*". The fact that, in spite of Sargent's statement, Regel did not mention the Bourgeau specimen in his first publication (*Bull. Mosc.*) but only in the second (*DC. Prodr.*) is significant; otherwise it might be involved in the typification of his *B. alba*, subsp. *verrucosa*, var. *resinifera* which, fortunately, was based solely on the Middendorf material.

The name *B. alba*, subsp. *papyrifera*, var. *humilis* has the right-of-way.

7. *B. BOREALIS* Spach in Ann. Sci. Nat. sér. 2, xv. 196 (1841). *B. pumila*, γ. *borealis* (Spach) Regel in Nouv. Mém. Soc. Nat. Mosc. xiii. 113—repr. Mon. Bet. 55, t. 13, figs. 38 and 39 (1861) and in DC. Prodr. xvi². 173 (1868). *B. alba*, var. *carpatica* sensu Fernald in Am. Journ. Sci. ser. 4, xiv. 179 and 190 (1902) in part only, not *B. carpatica* Wald. & Kit. *B. microphylla* sensu Eames and sensu Fernald, as quoted by Eames, in RHODORA, xi. 93 (1909), not Bunge.—Southern Labrador to James Bay, Ungava, south, chiefly on calcareous or magnesian soils to Newfoundland, Anticosti Island and Gaspé Peninsula, Quebec, and very rarely to Cape Breton and to northern Vermont.—Since this characteristic and very definite northeastern species has not been understood during the full century since Spach very clearly described it as “Legit cl. de Lapylaie, in insulâ Terrae-Novae” (this later rendered by Regel “von Herrn de la Tylaie in Novaja Semlaja gesammelt”), it is important to cite and illustrate good material (all, unless noted, distributed erroneously as *B. microphylla* Bunge). LABRADOR: common on many barrens and hill-sides, Backway, off Lake Melville, R. H. Wetmore, no. 102,930. NEWFOUNDLAND: 1 m. high, peaty limestone barrens, southern half of Burnt Cape, Pistolet Bay, Fernald & Long, no. 28,070; cool springy glade, Burnt Cape, F. & L., no. 28,075; limestone barrens on the Highlands northeast of Big Brook, Straits of Belle Isle, Fernald, Wiegand & Hotchkiss, no. 28,072; shrubs 1–2 m. high, spruce woods and thickets bordering limestone barrens, Brig Bay, Fernald, Long & Dunbar, no. 26,596; spruce woods and thickets, St. Barbe, F. L. & D., no. 26,595; 1–2 m. high, thickets along East Brook, St. Barbe Bay, Wiegand & Hotchkiss, no. 28,080; slaty gorge of brook below serpentine barrens above Woody Point, Bonne Bay, R. H. Kimball, no. 117; 1–2 ft. high, quartzite gravel and talus, Killdevil, Fernald, Long & Fogg, no. 1636; gravelly beach, Middle Birchy Pond, Eastern Drainage of Humber R., Fernald & Wiegand, no. 3247 (as *B. alba*, var. *carpatica*); coarse shrub, southerly slopes of dry serpentine ridge, North Arm, Bay of Islands, Long & Fogg, nos. 217 and 219; dry thicket on exposed slope at about 1650 ft., Blow-me-down Mt., Eames & Godfrey, no. 6033; serpentine and magnesian limestone barrens, northeastern base and slopes of Blomidon (“Blow-me-down”) Mts., Fernald & Wiegand, nos. 3245 (as *B. alba*, var. *carpatica*) and 3246; large shrubs, dry limestone barrens, upper slopes and tablelands, alt. 200–300 m., Table Mt., Port-à-Port Bay, Fernald & Wiegand, no. 3250 (as *B. alba*, var. *carpatica*), also Fernald & St. John, no. 10,827; coarse shrub, thickets on gneiss ledges along Grandy Brook, Distr. of Burgeo and La Poile,

Fernald, Long & Fogg, no. 218; springy and boggy places in river-gravel, Gander R., Glenwood, *Fernald & Wiegand*, no. 5308 (as *B. alba*, var. *carpatica*); gravelly river-bank, Glenwood, *F. & W.*, no. 5309 (as *B. alba*, var. *carpatica*). QUEBEC: 4 ft. high, rocky crest, Pointe au Maurier, Charnay, Saguenay Co., *St. John*, no. 90,385; granite hills, Mingan, *St. John*, no. 90,384; limestone sea-cliffs, Ile Ste. G  n  vi  ve, Mingan Ids., *St. John*, no. 90,830; sur les rivages calcaires pr  s du Lac Sal  , Ile St.-Charles, Archipel de Mingan, *Victorin & Rolland*, no. 18,881; bordant le sommet de l'escarpement, Ile Nue, Mingan, *V. & R.*, no. 24,728; rivages, Ile    la Chasse, Mingan, *V. & R.*, no. 24,740 (as *B. glandulosa*); wet places, Becscie R., Anticosti, Sept. 7, 1883, *J. Macoun*; le long des plat  res calcaires, Riv  re    la Patate, Anticosti, *Victorin, Rolland & Louis-Marie*, no. 21,726;    une douzaine de milles de l'embouchure, R. Jupiter, Anticosti, *Victorin & Rolland*, no. 24,729; arborescent, sur le bord de la falaise bois  e, le long du portage de la ligne, Sand-top, Anticosti, *V. & R.*, no. 27,775; cr  vices and talus of serpentine, Ruisseau    la Neige, Mt. Albert, Gasp   Co., *Fernald & Collins*, no. 532; large shrub, steep clay banks of Matane R., Matane, *Fernald & Pease*, no. 25,022; Rupert House, James Bay, *D. Potter*, no. 805. NOVA SCOTIA: low thicket in bog on plateau north of Bay St. Lawrence, Victoria Co., *Roland*, no. 41,354 (as *B. pumila*). VERMONT: rock-outcrop, shore of Fairfield Pond, alt. 550 ft., Fairfield, Franklin Co., *S. F. Blake*, no. 3105 (as *B. alba*, var. *minor*); summit of Mt. Mansfield, July 2, 1897, *Kennedy, Williams* (as *B. papyrifera*, var. *minor*), July 23, 1901, *T. O. Fuller* (as *B. papyrifera*, var. *minor*). PLATE 973.

Betula borealis was very fully and clearly described by Spach, whose description is worth repeating:

B. BOREALIS Nob.—Legit cl. de Lapylaie, in insul   Terrae-Novae; fors  n varietas *Betulae excelsae* v. *Betulae albae*.

Arbor? vel frutex? Rami haud resinoso punctati: novelli tomentosi. Folia floralia 6–15 lineas longa, ovato-v. obovato-v. lanceolato-v. oblongo-rhombea, acuta, subaequaliter serrato-dentata, basin vers  s integerrima, brev   petiolata: juniora pubescentia; adulta subt  s glaucescentia, spars   punctulata, reticulata, praeter nervos glabra. Stroboli subpollicares, erecti (?), brev   pedunculati, cylindracei, graciles; rachi gracili, fer   filiformi; squamis tricarpis cuneiformibus, subciliolatis, samaras obtegentibus, trilobis: lobis obtusis, aut subaequalibus, oblongis, nunc parallelis, nunc divergentibus, aut dissimilibus: lateralibus subfalcatis, deflexis, terminali abbreviato, subovato. Samarae ovatae v. suborbiculares, vix lineam latae, angust   alatae, squamis dupl   brevioribus. (V. s. sp. in Herb. Mus. Par.)

The densely tomentulose pubescence of vigorous new shoots, usually without glandular atoms, the elliptic to somewhat

rhombic or ovate merely acute or acutish leaves more or less pubescent beneath, and the small samaras with the wings scarcely broader than the achene, clearly distinguish it from the other dwarf species of the *Albae* in the Northeast: *B. minor*. There is little to induce one who knows *B. pumila* to place it with that, as was finally done by Regel. The identification with the Siberian *B. microphylla* Bunge was a very crude mistake, quite as unclarifying as my reduction to the latter of the cordilleran North American *B. occidentalis* Hook. (*B. fontinalis* Sargent).¹ *B. microphylla*, as originally described and as represented by Altai material sent by Regel to Gray and perhaps isotypic (PLATE 963, FIGS. 8–10), as well as by more modern specimens, has the small obovate leaves with entire cuneate bases, the summit only coarsely dentate; its branchlets are covered with resinous warts and the wings of its samaras (PLATE 963, FIG. 10) are as originally described by Bunge “semen longitudine et latitudine superantibus.” In *B. borealis* the acute or acutish leaves are toothed to base, the branchlets rarely glutinous and the wings of the samara narrow. *B. occidentalis* (*B. fontinalis*), although having broadly winged samaras and very gummy but glabrous branchlets and leaves, has the latter of firmer and heavier texture, more regularly serrulate or doubly serrate margins and usually an ovate outline and lingering pubescence on the upper surface. It does not well match true *B. microphylla* and is quite distinct from the eastern *B. borealis* and *B. minor*, the former with new branchlets heavily pubescent, and the samaras with very narrow wings, the latter glabrous from the first, with more slender fruiting aments and narrower samaras (2.5–5, av. 3.5, mm. broad), whereas the western *B. occidentalis* has the aments thick and the samaras 4–6, av. 5.2, mm. broad.

In *Betula*, ser. *Humiles*, two species need special discussion. The first is only doubtfully a member of this series, a tree of the mountains of western Virginia:

B. uber (Ashe), stat. nov. *B. lenta*, var. *uber* Ashe in RHODORA, xx. 64 (1918). PLATE 974, FIGS. 1–5.

It is most difficult to feel that the low tree (“20–25 ft. high”, according to Ashe’s label) described by Ashe as a small-leaved

¹ See discussion, pp. 313–317.

variety of *Betula lenta* has much, except aromatic bark, to do with that species. *B. lenta* (FIGS. 6 and 7) has cordate-ovate and long-acuminate leaves with fine and sharp serrulation and 10–20 pairs of veins impressed into the upper surface (a typical member of series *Costatae*). *B. uber*, on the other hand, as shown by isotypes at the Gray Herbarium and the Arnold Arboretum, has very short and broadly rounded, often nearly orbicular leaves with few coarse dentations and with only 3–6 pairs of veins not impressed above (characteristics of series *Humiles*). Furthermore, the pistillate aments are more slender than in *B. lenta* and the bracts end in low and broad lobes, those of *B. lenta* more elongate, with the middle lobe prolonged.

In describing his *B. lenta*, var. *uber* Ashe made no note of its size and he stated that the material, in young fruit and foliage, was collected on “Banks of Dickey Creek, Smyth County, Virginia, south of Rye Valley Station, January 14, 1914”. The isotype deposited in the Gray Herbarium has Ashe’s label, stating that the tree is “20–25 feet high” and that it was collected “At 2800 ft., June [not January], 1914”. It is very important to learn much more about *B. uber*,—whether it is shrubby, the range of variation of foliage, the characters of the staminate aments, and its abundance and range.

B. terrae-novae, sp. nov. (TAB. 975, FIG. 1–4), planta habitu *B. nanae*; ramis novellis tomentosus; foliis late cuneato-flabelliformibus coriaceis glabris valde reticulatis inciso-dentatis basin versus integerrimis; strobilis sessilibus 0.5–1 cm. longis; strobili squamis integerrimis vel subintegerrimis oblongis vel oblongo-lanceolatis vel oblongo-ovatis arcte adpressis apice subsquarrosis; nuculis ovoideis vel subrotundatis apteris margine incrassato.—*B. Michauxii* Spach in Ann. Sci. Nat. sér. 2, xv. 195 (1841), as to description, not as to Michaux plant, basis of the name. *Apterocaryon Michauxii* (Spach) Opiz in Lotos, v. 258 (1855), in part, not *B. nana* sensu Michx., basis of name. *B. nana*, s. *Michauxii* (Spach) Regel in Nouv. Mém. Soc. Nat. Mosc. xiii. 103—repr. Mon. Bet. 45 (1861), excluding Michaux plant, source of name.—Bogs, tundra and peaty, acidic barrens, Newfoundland and adjacent southeastern Labrador Peninsula. TYPE from diorite tableland, altitude about 550 m., northern region of the Blomidon (“Blow-me-down”) Mts., Newfoundland, Aug. 22, 1910, Fernald & Wiegand, no. 3271, as *B. nana*, var. *Michauxii* (in Herb. Gray.).

It is unfortunate that the name *Betula Michauxii* had so con-

fused a start. The tiny shrub of Newfoundland, southeastern Labrador and the extreme eastern end of the Côte Nord of Quebec is very distinct from the arctic *B. nana* (FIGS. 5-7) in its tomentose (instead of cinereous-puberulent) branchlets, its more flabelliform, more incised and more strongly reticulate leaves, and above all in simple instead of prominently 3-lobed pistillate bracts and its thick-margined, instead of definitely winged samaras. Spach gave a good description of it in general, but his "Strobili 4-8 pollices [inches] longi" was most unfortunate for any American birch and emphatically for a dwarf with strobiles only 5-10 mm. long! For his *B. Michauxii* Spach set up the new section *Apterocaryon*, which was clearly based on Newfoundland material: "Nuculae apterae, margine incrassato, intus suberoso, cinctae.—Squamae strobilae semper 1-carpae, integerrimae, nuculis duplo angustiores", and this was taken up as the genus *Apterocaryon* (Spach) Opiz. Further to confuse matters Spach started his description of the Newfoundland shrub: "B. MICHAUXII Nob.—*Betula nana* Michx.! Flor. Bor. Amer. (excl. syn.)" and gave the range "America borealis [derived from Michaux] et insula Terrae Novae [La Pylaie material at Paris, presumably]". The name *B. Michauxii* automatically belongs with the Michaux element which came from at least 650 miles farther west ("in sphagnosis, a sinu *Hudsonis* ad lacus *Mistassins*") than the western known limit of *B. terrae-novae*. Furthermore, the description of *B. nana* sensu Michx. Fl. Bor.-Am. 180 (1803), nomenclatural type of *B. Michauxii*, was of something quite different: the shrub "glaberrima" (instead of with tomentose branchlets); "amenti squamis profunde 3-partitis, laciniis oblongis" (instead of entire or merely with obscurely undulate margin); "capsulis orbiculatis, subapteris" (instead of quite apteris). Just what Michaux got we cannot learn at the moment. His description suggests one of the dwarf and glabrous or glabrescent extremes of *B. pumila* L., such as var. *renifolia* Fernald, which abounds on much of the Labrador Peninsula and in Newfoundland and which, in exposed situations, may become a tiny depressed mat with round-obovate to reniform leaves down to 8 mm. long and either pubescent or glabrous. Michaux's plant was, obviously, not at all the characteristic little shrub of the Newfoundland barrens.

The fact that Regel confused *Betula Michauxii*, as a variety,

with *B. nana* carries little weight. At the same time he also reduced *B. glandulosa* Michx. to his all-inclusive *B. nana*, as he likewise included the utterly different *B. borealis* Spach (our PLATE 973).

EXPLANATION OF PLATES

PLATE 963, FIGS. 1-7, *BETULA MINOR* (Tuckerm.) Fernald: FIG. 1, portion of TYPE, $\times 1$; FIG. 2, fruiting branch, $\times 1$, from Oakes Gulf, Mt. Washington, New Hampshire, *Eggleston*, no. 2676; FIG. 3, staminate aments, $\times 1$, from Mt. Washington, New Hampshire, *Greenman*, no. 1087; FIG. 4, lower surface of leaf, $\times 5$, from no. 2676; FIG. 5, branchlet, $\times 10$, from no. 2676; FIG. 6, fruiting bract, $\times 4$, and FIG. 7, samara, $\times 4$, from no. 2676. FIGS. 8-10, *B. MICROPHYLLA* Bunge: FIG. 8, fruiting branch, $\times 1$, from the Altai of Siberia, probably an ISOTYPE; FIG. 9, fruiting bract, $\times 4$, and FIG. 10, samara, $\times 4$, from same specimen. FIG. 11, *B. ALBA* L., var. *TORTUOSA* (Ledeb.) Schneider: samara, $\times 4$, from Kingua Tunugdliarfik, Greenland, Aug. 17, 1888, *Kolderup Rosenvinge*.

PLATE 964, *B. PAPHYRIFERA* Marsh. (typical): FIG. 1, fruiting branch, $\times 1$, from Middlebury, Vermont, July 8, 1908, *E. F. Williams*; FIG. 2, staminate aments, $\times 1$, from Winchester, Massachusetts, May 9, 1897, *E. F. Williams*; FIG. 3, tip of young shoot, $\times 5$, from Lac Ste.-Anne, Gaspé Co., Quebec, *Victorin, Rolland & Jacques*, no. 33,476; FIG. 4, fruiting bract, $\times 4$, and FIG. 5, samara $\times 4$, from Southport, Maine, Aug. 8, 1894, *Fernald*.

PLATE 965, *B. PAPHYRIFERA*, var. *COMMUTATA* (Regel) Fernald: FIG. 1, portion, $\times 1$, of the *Lyall* specimen from "Cascade Mountains, 49 N. Lat."; FIG. 2, characteristic close bark, $\times 1$, from Percé, Quebec, July, 1905, *Williams, Collins & Fernald*; FIG. 3, outer bark exfoliating, exposing whitish inner bark, $\times 1$, from base of same tree as in fig. 2; FIGS. 4 and 5, fruiting bracts, $\times 4$, from the *Lyall* specimen; FIG. 6, samara, $\times 4$, from the *Lyall* specimen; FIG. 7, fruiting bract, $\times 4$, from Bayview, Gloucester, Massachusetts, Aug., 1944, *Elizabeth Johnston*; FIG. 8, samara, $\times 4$, from the same specimen as fig. 7.

PLATE 966, *B. OCCIDENTALIS* Hook., var. *FECUNDA* Fernald: FIG. 1, portion of TYPE, $\times 1$; FIG. 2, younger (flowering) branchlet, $\times 1$, from type-locality, May 11, 1901, *Piper*; FIG. 3, staminate aments, $\times 1$, from type-locality, April 27, 1925, *Constance et al.*, no. 1043.

PLATE 967, *B. PAPHYRIFERA*, var. *PENSILIS* Fernald: FIG. 1, portion, $\times 1$, of TYPE; FIG. 2, fruiting bract, $\times 4$, and FIG. 3, samara, $\times 4$, from TYPE; FIG. 4, younger branch, $\times 1$, from Bic, Quebec, July, 1905, *Williams, Collins & Fernald*.

PLATE 968, FIGS. 1-3, *B. PAPHYRIFERA*, var. *MACROSTACHYA* Fernald: FIG. 1, portion, $\times 1$, of TYPE; FIG. 2, fruiting bract, $\times 4$, and FIG. 3, samara, $\times 4$, from TYPE. FIG. 4, forma *LONGIPES* Fernald: portion, $\times 1$, of TYPE.

PLATE 969, *B. PAPHYRIFERA*, var. *ELOBATA* (Fernald) Sargent: FIG. 1, portion, $\times 1$, of TYPE; FIG. 2, immature samara embraced by bract, $\times 4$, from TYPE; FIG. 3, young bracts, $\times 1$, from TYPE.

PLATE 970, *B. PAPHYRIFERA*, var. *CORDIFOLIA* (Regel) Fernald: FIG. 1, portion, $\times 1$, of fruiting branch from Malbaie, Gaspé Co., Quebec, August 20, 1904, *Collins, Fernald & Pease*; FIG. 2, tip of vigorous sprout, $\times 5$, from Roberval, Quebec, July 28, 1892, *G. G. Kennedy*; FIG. 3, fruiting bract, $\times 4$, and FIG. 4, samara, $\times 4$, from same specimen as fig. 1.

PLATES 971 and 972, *B. PAPHYRIFERA*, var. *HUMILIS* (Regel) Fernald & Raup. PLATE 971: FIG. 1, portion, $\times 1$, of TYPE of *B. alba* L., subsp. *papyrifera* (Marsh.) Regel, var. *humilis* Regel, with Regel's identification; FIG. 2, lower surface of leaf (with scattered trichomes), $\times 10$, from TYPE; FIG. 3, fruiting bract, $\times 4$, and FIG. 4, samara, $\times 4$, from TYPE; FIG. 5, fruiting tip, $\times 1$, of specimen from Prince Albert, Saskatchewan (*Macoun*, no. 12,952^a), one of the 2 specimens cited by Sargent as his *B. alaskana*. PLATE 972, FIG. 1, portions,

× 1, of the Saskatchewan plant (*Bourgeau*, 1858), the first specimen cited by its author for *B. alaskana* Sargent: FIG. 2, fruiting bract, × 4, and FIG. 3, samara, × 4, of the Prince Albert material, *Macoun*, no. 12,952^a; FIG. 4, fruiting bract, × 4, and FIG. 5, samara, × 4, from near Fairbanks, Alaska, *Ynez Mexia*, no. 2291.

PLATE 973, *B. BOREALIS* Spach: FIG. 1, branches, × 1, from Glenwood, Newfoundland, *Fernald & Wiegand*, no. 5308; FIG. 2, fruiting branch, × 1, from Glenwood, *Fernald & Wiegand*, no. 5309; FIG. 3, tip of young branch, × 5, from no. 5309; FIG. 4, fruiting bract, × 4, and FIG. 5, samara, × 4, from base of Blomidon, Bay of Islands, Newfoundland, *Fernald & Wiegand*, no. 3246.

PLATE 974, FIGS. 1-5, *B. UBER* (Ashe) Fernald: FIG. 1, portion, × 1, of ISOTYPE in Herb. Arnold Arboretum; FIG. 2, upper surface of leaf, × 2, to show venation and toothing, from ISOTYPE; FIG. 3, portion of lower surface of leaf, × 2, from ISOTYPE; FIG. 4, fruiting bract, × 4, and FIG. 5, samara, × 4, from ISOTYPE. FIGS. 6 and 7, *B. LENTA* L.: FIG. 6, portion of lower surface of leaf, × 1, to show venation and toothing, from Jamaica Plain, Massachusetts, August 25, 1885, *C. E. Faxon*; FIG. 7, fruiting bract, × 4, from same specimen.

PLATE 975, FIGS. 1-4, *B. TERRAE-NOVAE* Fernald: FIG. 1, portion of TYPE, × 1; FIG. 2, tip of branchlet, × 5, from Goose Pond, upper Humber River, Newfoundland, *Fernald & Wiegand*, no. 3272; FIG. 3, fruiting bracts, × 10, and FIG. 4, nutlet, × 10, from TYPE. FIGS. 5-7, *B. NANA* L.: FIG. 5, tip of branchlet, × 5, from Velmunden, Norway, July 23, 1909, *Fr. Lange*; FIG. 6, fruiting bract, × 4, and FIG. 7, samara, × 10, from the *Lange* specimen.

(To be continued)

A NEW SPECIES OF *ANULOCAULIS* FROM SOUTHWESTERN TEXAS AND ADJACENT NEW MEXICO

U. T. WATERFALL

SEVERAL collections of *Anulocaulis* were made by the author while botanizing in the Transpecos Region of southwestern Texas and adjacent New Mexico during the summers of 1942 and 1943, and October, 1944. The majority of these were of a plant having large, pallid, eglandular leaves, and long flowers. One collection, my no. 5026 from near the Finlay gypsum quarry in Hudspeth County, was characterized by smaller, greener, papillate-glandular leaves, and by smaller flowers. The latter plant agrees with Torrey's description of *Boerhaavia leiosolena*,¹ the type of which was taken along the Rio Grande about 50 miles southeast of Finlay. The other specimens do not agree with it in several respects.

Most authors have treated the plants as one species, their descriptions merging the characteristics of Torrey's plant with those of later collections which have been almost entirely of the

¹ Torrey, John. *Botany of the Mexican Boundary*, 172. 1859.